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Next 2 Page(s) In Document Denied

Explosion, Graphite Fire Suspected

U.S. Specialists Differ on Meltdown; Satellite Observes Site

By Boyce Rensberger
Washington Post Staff Writer

U.S. experts on nuclear power said yesterday they were unable to determine exactly what happened at Chernobyl but there were growing indications that the Soviet nuclear power plant had experienced a massive explosion and fire that destroyed the building's roof and collapsed parts of its walls.

As of early Tuesday, according to a ranking administration official, U.S. intelligence agencies had determined that smoke, undoubtedly laden with radioactive atoms, was still billowing from the plant. They said a satellite also observed the

collapsed roof and walls. Sen. Malcolm Wallop (R-Wyo.) said after an intelligence briefing late yesterday that the level of radiation from the plant was so high it was "possible even to cause instantaneous death."

The smoke is believed to be from a huge block of burning graphite, several stories tall, that is part of the reactor's core.

Although the experts differed on whether the reactor had experienced a meltdown, most said they thought such a possibility was likely.

The graphite fire reminded many U.S. experts of a similar accident at Britain's Windscale reactor in 1957. The reactor's graphite burned for four days, spewing what is believed to have been the largest amount of radioactivity to escape from a power plant, before it was flooded with water and extinguished.

Kenneth L. Adelman, head of the U.S. Arms Control and Disarmament Agency, told a Senate subcommittee yesterday that the fire at Chernobyl "will continue for several days" and that "nothing could be done other than to let it die down."

The experts said there were many ways in which an explosion could occur in a facility such as Chernobyl, but that a bomblike atomic blast is virtually impossible. More likely, they said, there may have been an explosion in the reactor's high-pressure hot water lines or a runaway heat release from the graphite during special maintenance that is periodically necessary with some graphite reactors. Wallop told reporters that the explosion came from a "hot spot in a [fuel] rod or several rods."

The basic principle is the same in all atomic power plants: Radioactive fuel (long rods of uranium oxide in this case) spontaneously produces heat, which is absorbed (by water in this case) and used to boil water into steam, which spins turbines linked to generators.

The heart of the Chernobyl reactor is the graphite block, in which there are about 1,700 vertical shafts. Inside each shaft is a hollow steel tube containing one fuel rod running most of its length. Water is pumped into the bottom of each tube. As it flows up, it absorbs heat from the fuel rod and boils off at the top. Hot water and steam are piped away from the top of each tube and the steam is sent to drive the turbines.

Anything that caused this water to stop flowing over the fuel rods could allow their natural heat to build to the melting point. If that happened, the heat could melt through the tube wall and ignite the surrounding graphite.

Because the fuel rods contain a variety of radioactive elements, most being the products of the nuclear fission that generates the reactor's normal heat, these elements could then vaporize in the high heat. Because the Chernobyl plant lacked the kind of pressure-containment dome that is standard on most U.S. reactors, the radioactive substances were free to escape, especially since the reactor building's roof was either blown off or burned away.

"That graphite fire makes this situation even more scary," said Ernest Silver, a physicist who edits "Nuclear Safety," a technical journal. "The fire would be a handy medium for sweeping radioactive material out of the reactor and into the environment."

Some experts, however, suspect there was no meltdown. D. Allan Bromley, a nuclear physicist at Yale, said it was more likely that the explosion came from the graphite itself during a maintenance mishap. This is what happened in the Windscale accident.

The maintenance is necessary because, over time, radiation from the fuel alters the crystal structure of the graphite, causing it to bulge—a phenomenon known as the Wigner effect for its discoverer, Eugene W. Wigner. Technicians periodically remove the bulge by allowing the graphite to heat to higher-than-normal temperatures.

This realigns the crystal structure and causes the graphite to release additional heat of its own. Bromley said that if this procedure were done improperly, the sudden release of heat could suddenly boil the water in the tubes, raising its pressure enough to cause an explosion, bursting the tubes and igniting the graphite.

"I can't imagine anything that would cause a meltdown in this reactor," Bromley said. "There is no fuel meltdown. The temperatures are not high enough."

Bromley said that if a mishandled Wigner effect caused the Chernobyl accident, radioactive materials could escape as heat from the burning graphite eroded the surface of intact fuel rods.

Whatever the cause of the explosion, the fact that the graphite is burning—probably at around 4,000 degrees Fahrenheit—led the experts to think that the radiation release would probably continue for days.

Adelman said that because the plant is on the Pripyat River, which flows into a reservoir that supplies drinking water to the major city of Kiev, about 60 miles to the south, there was a major danger of water contamination.

Fallout settling on the Pripyat watershed could be washed into the river by subsequent rains, posing a long-term hazard.

Adelman said the fire was burning "at such a fantastic temperature" that it threatened to burn down to the water level. If this happens, high concentrations of radioactive material could wash from the site directly into the river.

After a Senate briefing yesterday by unidentified intelligence officials, Sen. Patrick J. Leahy (D-Vt.) said there were indications that the radiation released at Chernobyl was vastly higher than during the accident at the Three Mile Island plant in Pennsylvania in 1979.

"We had justifiable concern about Three Mile Island and this is hundreds of thousands of times, perhaps millions of times, worse than anything that happened at Three Mile Island," said Leahy, the ranking Democrat on the Select Committee on Intelligence.

Exhaustive studies of the TMI accident have estimated that the radiation released then was enough to cause one additional case of fatal cancer.

The impact of a nuclear accident on the food chain is also of critical concern. Wallop said radioactive iodine was falling on pasture land near the Soviet plant. Similar contamination has been reported as far away as Sweden. As dairy cows take up the iodine, they concentrate it in their milk, posing a health threat.

Amid the generally shared expressions of sympathy for the impact of the disaster on the Soviet people came one contrasting note. "It's too bad," said Sen. Ste Symms (R-Idaho), "it didn't happen closer to the Kremlin."

Staff writers Philip J. Hills, Walter Pincus and Helen Dewar contributed to this report.

Page Denied

Next 1 Page(s) In Document Denied

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Next 1 Page(s) In Document Denied